A CLINICAL STUDY OF TRICHOCEPHALUS DISPAR.

BY

J. MURDOCH BROWN, M.B. & C.M.

I am indebted to Messrs John D. Comrie, M.A., and J. Lückhoff for the mounted preparations and sections. These, by the kind permission of Professor Rutherford, were made in the Physiological Laboratory of the University.

The microphotographs were taken by Mr J. Hume Patterson, Research Laboratory of the Royal College of Physicians, Edinburgh.

The drawings are by Mr J. T. Murray.

BIBLIOGRAPHY.

EBERTH, J.

The Anatomy and Physiology of the Trichocephalus Dispar, in *Zeitschrift für Wissenschaftliche Zoologie.* 1860.

LEUCKART, RUDOLF.

The Parasites of Man, and the Diseases which proceed from them, translated by Wm. E. Hoyle, M.A. (Oxon.), &c. 1886.

DAVAINE, C.

Traité des Entozoaires et des Maladies Vermineuses de l'Homme et des Animaux domestiques. 1860.

HELLER.

Article, "Intestinal Parasites," in Ziemssen's *Cyclopædia of the Practice of Medicine*, vol. vii. 1877.

COBBOLD, T. SPENCER.

Parasites: A Treatise on the Entozoa of Man and Animals. 1879.

BELLINGHAM.

Paper on the Frequency of the Presence of the Trichocephalus Dispar in the Human Intestines. *Dublin Journal of Medical Science*, vol. xii. 1838.

GIBSON, DANIEL, M.R.C.S., L.S.A.

Paralysis with Loss of Speech from Intestinal Irritation. *Lancet*, Aug. 9, 1862, p. 139.

GALGEY, OTHO, M.R.C.P.L.

On the Prevalence of Ankylostomiasis in St Lucia, and its Treatment. *British Medical Journal*, Jan. 23, 1897, p. 200.

HARDIE, DAVID, M.D.

Ankylostomiasis. *Medical Annual*, 1897, p. 113.

PEPPER.

A System of Practical Medicine, vol. ii., p. 954.

INTRODUCTION.

In selecting a subject for a Thesis to be submitted to the Medical Faculty I have, from a lengthened experience, chosen one which seems to me to be of special clinical interest and importance as illustrating the operation of morbific causes which might readily escape detection, but upon the due recognition of which everything depended for correct diagnosis and effective treatment. Although the facts relate only to one case, it is hoped they will be found to have been investigated with sufficient care to render them deserving of being placed upon record as an addition to our knowledge of a malady regarding which comparatively little is known clinically, as well as a contribution to Practical Therapeutics.

The first part of this Thesis is devoted to an account of the patient's ailments and the efforts that were made to deal with the various morbid manifestations,—efforts that were for the most part futile. The second part deals with the case and its successful treatment, when the importance of the presence of the *Trichocephalus dispar* in large numbers was recognised as most probably the cause of most of the morbid phenomena; and includes an account of all that I have been able to learn that is known clinically regarding *Trichocephalus dispar* as recorded by recognised authorities.

A CLINICAL STUDY OF TRICHOCEPHALUS DISPAR.

THE patient whose case forms the subject of this Thesis came under my care on 21st June 1896. She is a lady thirty years of age, the wife of an officer in the French army, who also represents one of the old titled families of France. She is of Scottish parentage, and resided in Scotland for the most part until married six or seven years ago, since which time she has lived in France with the exception of visits to her home in this country. Twelve years ago she first came under my care for a slight throat ailment; ten years ago she was under my care for a well-marked attack of scarlet fever, from which she made a perfect recovery without sequelæ. In the interval between that time and the present I have seen her on a few occasions for trifling dyspeptic affections and slight anæmia. In every other respect she was a healthy, vigorous woman, and had borne a healthy child.

On 21st June 1896 I was requested to see her, as she was suffering from profuse diarrhœa, when it was stated that she had suffered from several attacks of a febrile nature, the description of which resembled closely those of an intermittent fever. Associated also with the diarrhœa there were abdominal pains of a colicky character.

The result of the examination of the patient in bed showed that there were no abnormal physical signs. She was tall, well formed, somewhat sallow in complexion; but the lips, gums,

and conjunctival membranes were well coloured. There was some tenderness in the lower abdominal regions, especially in the iliac fossæ; but this was not pronounced, nor did it appear to be constant. The tongue was slightly furred, but moist. The appetite was good. The urine was normal. The stools were very liquid, of a dark-brown colour, not offensive, and contained a little mucus, but no blood nor pus. Many of them were passed during the night, and this interfered to a corresponding extent with her sleep. Menstruation was regular, though somewhat defective in amount. I was informed that some months before she had in Paris had the womb "scraped."

I found that she was not careful in her diet nor in her mastication, so I gave her suitable direction as to both, together with some pills containing acidum carbolicum and pepsina porci, in order to correct some degree of flatulence. It must be understood that at this time she was going about freely, that she lived fully four miles away from me, and that, therefore, my interviews with her were irregular and infrequent.

On 24th June she called on me, complaining of nausea, pain, and diarrhœa. I prescribed for her bismuth with lactopeptine, Indian hemp, and chloroform water, together with a carminative of spirit of chloroform and tincture of cardamoms for occasional use.

On 30th June she was ordered small doses of sulphate of quinine, as there had been some slight fever and a loss of appetite. She continued to go about freely until the middle of July, her chief complaints still being nausea and diarrhœa. Owing to the freedom of her life at this time no accurate record could be kept, but a properly qualified nurse was secured in the middle of July.

Early in the morning of 17th July she had her first well-pronounced attack of fever. It was ushered in by a feeling of intense coldness and nausea, the temperature rose to 104°; after some hours profuse perspiration set in, and next morning

it had fallen to 98·4°. On 18th July no fever was observed. On 19th, 20th, 21st, 24th, 29th, and 30th July, and on 10th, 16th, and 24th August, there were similar attacks, the temperatures observed varying from 101° F. to 104° F. Owing to the misery which the patient experienced during the attacks, it was not always possible for the nurse to make temperature observations. The attacks mostly occurred after midnight, so that I was unable to observe them myself, although I went several times for the purpose. On these occasions the pulse rose to from 110 to 120 per minute, and after the attacks—*i.e.*, during the day—it fell to between 70 and 80.

During the latter part of August the attacks of pyrexia became more frequent and severe, and the patient's general health began to suffer seriously. During July and onwards there was much nausea, to control which she had a mixture of bismuth and pepsine. For the diarrhœa, fluid extract of bael was used, and lavage of the bowel with one litre of tepid water with seventy grains of tannic acid dissolved in it, was practised daily from 23rd July, and continued for three weeks.

Towards the end of July, the mother of the patient gave me information which seemed to throw much light on the case. It was to this effect: That for several years her daughter had been in the habit of frequently eating considerable quantities of earth, —in fact, that it was an almost constant and irresistible habit. It did not matter from where the earth came—flower pots afforded an easy means of gratifying this morbid appetite. She also told me that when abroad and happening to be in any musty, earth-smelling church or cathedral her enjoyment was intense, and that she would sniff at and almost lick the stone walls. I immediately directed my attention to the stools, and found, on pouring off the supernatant fluid, that there was a well-marked residuum, which, when washed, contained gritty particles; these, however, disappeared in a few days after the earth-eating had been entirely stopped. I considered that the diarrhœa might

have been due to the irritation caused by the earth in the intestine, and ordered her a mixture containing small quantities of castor oil, tincture of opium, and cinnamon, the whole emulsionised with yolk of egg. This mixture seemed to give considerable relief to the pain in the bowels which she suffered from, and its administration also was followed by a diminution in the number of stools. It was continued for about a fortnight, and alternated then with chalk mixture.

The number of stools passed in the twenty-four hours during almost the entire time the patient was under treatment varied, sometimes as many as thirteen, sometimes as few as six. Great difficulty was experienced in keeping a record which could be considered at all reliable.

In August and the early part of September I was mostly out of town, but saw the patient several times. She was left under efficient care, and was seen several times by consultant physicians, whose names I need not mention here. She was confined to bed for several days at a time, in the hope that the fever might be abated by rest, while on other days, on account of her active and lively disposition, she was out in the garden; but, exerting herself too freely, she usually had one of her attacks of fever during the night.

While under the care of those who acted in my absence, her diet was for some time rigorously confined to milk and peptonised food, while she had administered to her a mixture of arsenite of copper with liquor opii sedativus, powders containing calomel and Dover's powder, and, on 1st September, salol in five-grain doses was given four times daily, while calomel and pulv. kino co. in powder were given thrice daily. The salol was gradually increased until ten grains were given four times daily. A reference to the chart will show that the salol seemed to have the most salutary effect as regards the temperature, while the diarrhœa was somewhat diminished.

In September a careful examination of the stools was made

at the Laboratory of the Royal College of Physicians here, and also by Dr Sims Woodhead in London, and, in addition, by Dr William Russell, who informed me that he had found ova of the *Trichocephalus dispar* in the fæces. This discovery was confirmed by Dr Noël Paton. We were disposed at the time to look on this as an interesting curiosity.

Having resumed charge of the case about the middle of September, I found that the patient was in a much worse condition physically than in summer. She had lost flesh to a considerable extent, her nausea at times was overpowering, she could only lie on her right side in bed owing to uneasiness in her chest when she lay on her left side. Her appetite was capricious, and she had occasional asthmatic attacks. Her pulse, fairly good in tension, was seldom under ninety, her complexion was paler, and her lips bluish in colour at times, but no physical signs of pulmonary nor cardiac disease could be detected. Considering that the salol seemed to act so beneficially, I caused half a dram of it to be injected into the bowel in a half litre of water, while I increased the amount given by the mouth to fifteen grains four times daily; and for the diarrhœa I ordered a lead and opium pill every four hours. The last I stopped, as she complained of increased nausea after she had taken about half a dozen. Although the salol was doing so well, it had to be diminished in quantity because the nausea increased and the urine became discoloured to a considerable extent. She, however, improved in her general health, and was able to go out for short drives. Feeling herself so much better, she greatly over-exerted herself one day in Edinburgh, and on 30th October had a violent return of fever, together with a bronchial catarrh; and a reference to the charts will show that this fever was very persistent, and that it was accompanied by an aggravation of all her symptoms. There were great emaciation, weakness, mental depression, anorexia, and asthmatic attacks; menstruation was also arrested, but the

diarrhœa did not increase. She was confined entirely to bed for a considerable time.

On 31st October quinine in four-grain doses was administered, and was followed after some days by a re-exhibition of salol in smaller doses. The bronchial catarrh and cough were treated by counter-irritation to the chest with mustard, and by the administration of hydrocyanic acid, and syrup of codeia, with inhalations of pinol, menthol, and benzoin, and ultimately with petroleum emulsion. The catarrh, however, persisted for some weeks, but ultimately entirely disappeared. By advice of another consultant a rigid milk diet was enjoined, and fifteen-grain doses of iodide of potassium together with tabloids of arsenious acid. This treatment was commenced on 13th November, and persisted with for a fortnight without appreciable result in a favourable direction.

The patient's mother being anxious to know whether the operation in Paris could have anything to do with the prolonged illness, I obtained the assistance of a gynæcologist, who found the reproductive system normal and no cause of any kind there for the attacks of fever.

I now come to the treatment which has been followed by the happiest results, and beg to state the reasons that led me to adopt it.

I had formed the opinion that in her earth-eating, which was largely indulged in while she resided in Tours and Dinan, she had swallowed many objectionable *materies morbi* which might account for the malarial-like fever from which she suffered, and also for the persistent diarrhœa. The discovery by Drs Russell and Paton of the ova of the *Trichocephalus dispar* in the stools led me to make frequent examinations of them, and the numbers of ova I found were simply incalculable, and could only be produced by a great number of whip-worms. Was this then the possible cause of the prolonged diarrhœa? and,

if so, how could the affection best be treated? Consultation of the recognised authorities in books gave very little assistance. Purgation was all that I could find recommended, and irrigation of the bowel, but here was a patient, one of whose leading symptoms was over-purgation!

Having thought over everything likely to reach and kill the Trichocephali, I decided to exhibit thymol, and on 7th December 1896 the patient had administered to her per rectum one litre of tepid water with ten grains of thymol (dissolved in rectified spirit and glycerine), by gravitation. I began with this comparatively weak solution so that I might not irritate the mucous membrane of the bowel, and by causing pain put the patient in opposition to the treatment. (I may here mention that, although on the whole obedient, she was an only child somewhat spoiled, and retained a good deal of the caprice and petulance of her childhood.) The solution proved quite strong enough; she complained of it burning her, but not very severely. On this account and by reason of her weakness and the distress it caused, the injection of thymol was given only every second or third day.

Up till this time no specimen of the Trichocephalus had been observed, although carefully looked for. For about ten days the bowel was very intolerant of the thymol. This intolerance, however, gradually became less, and the patient was able to retain the solution for some time. An easily recognised specimen of Trichocephalus was found a fortnight after the commencement of the thymol treatment, and was followed three days afterwards by five more. The worms came away, not when the fluid of the injection returned, but in the subsequent stools, and the numbers obtained daily varied, sometimes as many as thirty, sometimes as few as five or six. Still, the evacuation of worms was constant. The injections were given more frequently in February, and from the 11th on to the 18th, the patient feeling much encouraged by the results,

we were able to use two litres of fluid of the same strength of thymol. On the 16th, 17th, and 18th February, the daily passage of Trichocephali respectively numbered 37, 17, and 32. Up till this time 348 Trichocephali were obtained from the stools by washing and filtration. Of these 79 were males, and 269 females. As the patient was now taking a mixed diet, care had to be taken to discriminate between the worms and indigestible vegetable fibres, which were sometimes mixed with the worms presented to me by the nurse. Some of the worms may have escaped detection; the above number represents what I had actual possession of.

On 19th February the patient left for the South of France, with the instructions that the injections of thymol were to be continued as regularly as possible, until no ova could be found, nor any worms discovered in the stools.

While determined to clear out the great intestine as thoroughly as possible by the thymol treatment, I thought something might also be done for the small intestine, so the patient was ordered five-grain doses of Beta naphthol in cachets by the mouth, one cachet to be given thrice daily. This was carried on simultaneously with the thymol injections, and though the patient complained of the naphthol burning her, she persevered to some extent with it, albeit not so regularly as could have been wished, had one been depending on the naphthol alone.

At New Year 1897 a manifest improvement in the general health was observed. Nausea disappeared, the appetite improved, the tongue, previously thickly coated, began to clean. She soon became able to lie and sleep on either side; sulphonal—formerly necessary—was less frequently required; and by the middle of January she was able to be up for several hours daily. The fever still persisted, but there was seen a marked diminution in the pyrexia after 19th January, and, while it was present, her distress was not nearly so great as before. On 28th January the

temperature rose to 101·4° (this was after being out too long); on 31st January it rose to 103·4°, and on this occasion was associated with the vomiting of bilious material and pain in the region of the uterus and bladder, which passed away when menstruation became established. On 4th February a temperature of 100·2° was registered; after the 6th it became normal, and continued so until she left this country, as reference to the charts will demonstrate. The pulse was of good tension, averaging sixty-five per minute. Her condition when she left was entirely satisfactory. The stools were much less liquid and fewer, and she had discontinued the use of the water-bed for a fortnight previously, and was rapidly gaining flesh and strength. She stated that she felt perfectly well, and would have considered herself so but for the fact that she knew that worms were still being found. For ten days previous to her departure she had been driving and walking about, attending to all the details necessary for one who was going abroad, or rather to her home at Dinan, Côtes du Nord, whither, I may add, she is to proceed at the end of the month (April).

I conclude my recital of this special case by giving an extract from a letter received from the patient, dated Cannes, 8th March: "We arrived here safely. I was not very tired by the journey. I am feeling exceedingly well, and am continuing to take those horrible injections *every* morning with many groans of anguish. The injections have not had a complete effect as yet. I hope I shall soon require no more." And from her mother, dated Cannes, 8th March: "I am glad to be able to give you good accounts of F——, who is really now quite well, I may say, as regards her general health, and her strength is returning every day." She adds, alluding to the search for Trichocephali: "It is difficult to see them now, as what is passed is thicker and more normal."

I may here state a circumstance not strictly germane to the case, but undoubtedly exercising some influence on the patient's condition. Her husband (after she had come home) was attacked by serious pulmonary disease, necessitating his going to various suitable

health resorts on the Continent. The knowledge of his condition was, as far as could be, concealed from her; but this was not always possible, and as the worst news came when she herself was very ill, it added to her mental depression.

It also led to her leaving for the Continent sooner than I would have wished. Naturally, however, her desire to rejoin her husband was very great, and had to be deferred to as soon as she had recovered sufficiently to travel with safety. The letters from Cannes show that happily the recovery was not interfered with.

This, then, is the narration of the case, which presented the following striking features:—

1. A history of much earth-eating, extending over several years.

2. An apparently intractable diarrhœa.

3. A prolonged condition of ill-health, in which the most distressing feature was a fever of intermittent type, each paroxysm being marked by distinct stages of shivering, nausea, high temperature, and profuse perspiration.

4. The presence of immense numbers of ova of *Trichocephalus dispar*, and inferentially of a correspondingly large number of the producing worms.

5. The inadequacy of all symptomatic treatment of the fever, diarrhœa, and helminthiasis, until the rational treatment by lavage of the bowel with thymol solution, associated with the occasional administration of Beta naphthol by the mouth.

6. The satisfactory result of the latter treatment in every particular, viz.:—

(*a.*) The fever gone.

(*b.*) The diarrhœa practically gone (the stools are now so thick that with difficulty they are examined for ova and worms).

(*c.*) The successful though necessarily gradual extirpation of the worms, as shown by the large number in my possession, and by the great diminution in the number of ova now to be found in the stools.

I would now venture to make some remarks on the special feature of interest, namely, the obscure but proved cause of the remarkable symptoms characterising the clinical history of this

case. A study of the literature of the subject of what may be termed Trichocephaliasis brings into prominence these facts:—

1. That the subject has mostly been studied from the post-mortem point of view, nearly all our information being derived from autopsies in which the worm—unsuspected during life—was found in the intestine of patients dying of other diseases.

2. The varying numbers of worms found in different subjects, and the large proportion of people who harbour the worms most frequently without apparent detriment, which latter circumstance may account for so little having been done in the way of thorough treatment.

3. The tenacity with which the worm adheres to the intestinal wall.

4. Its immense power of reproduction.

5. The great inherent vitality of the ova under various conditions most inimical to their life.

6. The absence of subjective or objective signs of definite or reliable character in connection with this parasite, beyond the finding of the ova in the fæces.

7. The inadequacy of the treatment hitherto adopted.

I. Post-mortem examinations have shown that the Trichocephalus is found chiefly in the cæcum and colon. Heller found a few in the small intestine, but these appeared to be smaller and more delicate than those found in the cæcum. Vix also found one, nine centimetres above the ileo-cæcal valve, and Wriesberg found one in the duodenum. One was alleged to have been found in the enlarged and degenerate tonsil of a soldier; but Heller, however, thinks this doubtful.

With regard to the ages of individuals harbouring the Trichocephalus, post-mortem examinations would seem to show that adults are much more frequently the hosts of the worm than children. Thus, in 1,755 post-mortem examinations made in Erlangen in ten years (1862-1872), in the cases of 845 males

the Trichocephalus was found in 12·7 per cent., in 513 females 13·5 per cent., and in 397 children under fifteen years of age 4·8 per cent. These figures, together with some interesting facts regarding the association of Trichocephali with other worms in the same hosts, are to be found in an inaugural dissertation by K. Müller, and are, I think, of sufficient importance to warrant my reprinting the table of statistics in an Appendix at the end of this Thesis.

Heller considers that even these figures are below the truth, "for some of the post-mortems were made by inexperienced hands and eyes; further, in private houses the intestines were, for other reasons, not all opened, or the surroundings, especially with regard to light, were often most unfavourable; and finally, single examples, especially of Oxyuris, often escaped observation." This latter might occur almost as easily in the case of the Trichocephalus.

Geographically the Trichocephalus is found in France, Germany, Italy, Denmark, England, Scotland, and Ireland, and also in North America. It is also very prevalent in Nubia, Egypt, and Syria. With regard to our own country, Cooper of Greenwich found it in eleven out of sixteen autopsies, and Bellingham at Dublin found it in eighty-one out of ninety autopsies, while Haldane in Edinburgh several times obtained large numbers at autopsies.

II. The numbers of the worm found vary greatly, from seventy to a hundred frequently, but as many as a thousand were found by Rudolphi. Heller thinks this latter must be extremely rare, but having obtained several hundreds from my living patient already, I am quite disposed to believe in the existence of immense numbers in some hosts.

III. The tenacity with which the worm adheres to the intestinal mucous membrane. The posterior thick portion of

the worm and a part of the thin portion lie loose on the mucous membrane, and are bathed in the contents of the bowel, while the head, with the anterior portion of the body, is firmly fastened to the mucous membrane. Heller considers that "the anterior part of the body is disposed of in several coils, in each of which it embraces a portion of mucous membrane," and he also thinks it possible that the longitudinal roughened band may aid their fixation by acting as a fastening apparatus. This band referred to is composed of short pieces of chitine set in the skin; it is on the abdominal surface of the worm near its anterior extremity, and is one-third the circumference of the body. Leuckart and Vix consider that the worm perforates the mucous membrane, tunnelling under it. Whichever of these views be correct, and probably both may occur in different cases, the fact of importance is that the worm is firmly anchored and most difficult to displace, and this has hitherto proved the obstacle to getting rid of it by purges and anthelmintics.

IV. Its great power of reproduction is shown in my case by the immense numbers of ova found in the fæces. They are simply innumerable. Leuckart has estimated the number of ova contained in the uterus of one worm at 58,000, and the yearly production of ova from 300,000 to 400,000, certainly a remarkable degree of fecundity.

V. The inherent vitality of the ovum is very great. It takes from six months to a year, or even more, for the production of the worm from the egg, according to the temperature and nature of its environments, and from six to eight weeks for its development in the alimentary canal. Their power of resistance is such that they can be dried up for long periods, or even frozen, and yet their subsequent development may take place. Heller had some frozen for several days without affecting their

vitality. The thickness of the shell doubtless affords the necessary protection from injurious agents. Leuckart states that the ova of Nematodes, which have a thick shell, "can remain a long time without injury to the development of the embryo, even in spirit, turpentine, chromic acid, and various poisonous liquids fatal to the fully-grown worm." I intend to try the effect of various substances on some of the ova in my possession, as Leuckart gives as his example of a thick-shelled egg that of Ascaris. But the thickness of the shell, although it may prevent poisonous influences reaching its contents, or render desiccation imperfect, cannot prevent the complete freezing of their contents, and this has been proved not to destroy the vitality. They require a temperature of 22·5° Centigrade for their development (Leuckart).

VI. With regard to the symptomatology of Trichocephaliasis I will quote what the most eminent authorities state on the subject. Davaine, whose classical work furnishes my first quotation, had ample opportunity for observing numbers of people who were the hosts of the Trichocephalus, for he states that he considered one half of the inhabitants of Paris harboured the worm. "The phenomena, or symptoms, caused by the presence of Trichocephali are entirely unknown." Felix Pascal stated in a memoir on the subject "that these worms caused the following pathological phenomena when very numerous. The pulse is small, concentrated, irregular, and intermittent, the face red, the eyes projecting, headache, and griping in the lower part of the abdomen." But these assertions have not been verified by others.

Davaine reports the observations in the case of a little girl aged four years who died with cerebral symptoms, and in whom were found at the autopsy a prodigious quantity of Trichocephali occupying the cæcum and colon. The child did not present a single sign by which the existence of these worms in the in-

testine could be diagnosed, and it is not usual to see them in water closets. One hardly watches for these parasites unless there be a grave attack of diarrhœa or dysentery, but the microscopical examination of fæcal matter renders the diagnosis easy and certain. The eggs of the worm are found in the evacuated matter.

Heller states that—"As to the medical importance of this worm, we cannot, on the whole, give a decided opinion. A few worms may, we think, be looked on as harmless guests; if a large number are present, it is not at all impossible they may have an injurious effect. The way they are fastened to the intestine is of importance when we are considering this question."

Referring to the tunnelling of the mucous membrane by the worm, which Leuckart and Vix consider to be the usual method of fixation, Heller says: "It cannot, therefore, be considered as the rule, and it must, therefore, be looked upon as questionable whether the mucous membrane is on this account more liable to the attacks of other disease. I have several times found from sixty to a hundred Trichocephali in the cæcum, without there being any perceptible change in its mucous membrane." Klebs also failed to find any penetration of the mucous membrane

"Serious symptoms connected with the nervous system are said by different authors to depend, especially in children, on the presence of these worms," but Heller considers that "a doubt as to the correctness of this idea up to the present time is quite allowable."

He concludes his observations by stating that "we know of no symptoms that depend on the presence of Trichocephali, we can only diagnose their presence by chance—that is, either by noticing a worm that has been expelled, or by finding the characteristic eggs when making a microscopical examination of the evacuations."

Leuckart, in considering the effects of parasites, remarks: "Besides the situation of the parasite, and the individuality of

the host, the number of imported germs in this connection is specially important, and to this, indeed, the effects produced and the dangers incurred are ever proportionate."

I do not think the conditions existing in my patient could be described in more pregnant words than the preceding.

Cobbold remarks: "Whip-worms rarely put their bearers to inconvenience; nevertheless, both human and animal hosts occasionally suffer from their presence."

Bellingham, referring to the results of his autopsies, in which, in twenty-six cases, he found the Trichocephalus, remarks "that not one of the twenty-six individuals in whom these worms existed had complained, either before or during the illness which proved fatal, of any symptom which could lead to the suspicion that these worms had been in the least degree prejudicial to their health."

I do not consider it necessary to quote further from recognised authorities as to symptomatology, or rather the want of symptomatology, in Trichocephaliasis, but will conclude by giving in complete detail a case printed in the *Lancet* of August 1862, which, if it be accurately recorded, differs greatly from any other case, both as to the numbers of worms observed and got from the living patient, and also in the apparent ease of the treatment. This case is quoted in various books, more, however, as a remarkable record than as an authoritative or reliable description. The article referred to is headed "Paralysis with Loss of Speech from Intestinal Irritation," and is as follows:—

E. B., aged six years, a cachetic, sallow-looking girl, was brought to my house by her mother on 18th April 1862, who gave the following account:—A week ago she noticed that the child was very peevish and cross; could not walk steadily; was constantly picking her hands and clothes. If set upon a chair she would fall down, if not held by the hand. When she attempted to speak, which she did imperfectly, she would very often bite her tongue; had also to hold it with her fingers so as to be able to swallow. I prescribed calomel, six grains; rhubarb powder, half a dram—to be made into six powders, one to be taken every night and morning; tincture of sesquichloride of iron, twenty minims; distilled water, three ounces—one tablespoonful three times a day.

19*th April.*—Has passed a small chamber vessel full of worms: species, *Trichocephalus dispar.*

21*st.*—Complete paralysis of the extremities. She is unable to stand; speech entirely gone. To continue with the mixture and powders.

23*rd.*—A little better in spirits; paralysis the same; has to be fed with a spoon.

26*th.*—In the same state.

30*th.*—No alteration. To continue with the mixture and the powders.

3*rd May.*—Has passed another chamber vessel full of worms.

6*th.*—Paralysis a little better; is able to stand when steadied by the hand. Speech the same; if she attempts to speak she bites her tongue. To continue with the mixture and powders.

8*th.*—Has passed more worms, and said "Mother."

10*th.*—Paralysis and speech gradually improving; she is able to feed herself.

11*th.*—Can walk upstairs by herself.

12*th.*—Has passed more worms. To continue with the mixture only.

14*th.*—Can walk, but still staggers and speaks very imperfectly.

16*th.*—Walks steadily and speaks very well.

20*th.*—Can walk as usual, and looks better than she has done for some time.

30*th.*—She has recovered, and is, as her mother states, in as good health as formerly.

The foregoing case, as recorded, presents an interesting example of temporary paralysis and recovery therefrom; but that a child of six years passed more than two small chamberfuls of *Trichocephalus dispar* is more than I can believe. I do not doubt the existence of intestinal worms of some sort in the case, but cannot consider that worms having such tenacity of hold as Trichocephali could be displaced in such large quantity by so simple a means. This I will refer to more particularly when the treatment of the condition of Trichocephaliasis is considered.

As to the symptomatology in my own case, I am met by the difficulty that the intermittent fever may have been due to other *materies morbi* swallowed in the patient's geophagic gratifications, more especially as the attacks of fever were most marked after she had made undue exertions, which would not of course increase the number of worms, but might weaken and render her more susceptible to the morbific influence, whether depending on the action of the worms, or some other less obvious cause.

The diarrhœa, I have no doubt, was due to the irritation caused by the large number of worms in her alimentary canal. As the worms became less in numbers, so the diarrhœa lessened; and it is possible that the disinfection of the colon by the thymol not only killed the worms, but I think it likely that it rendered

inactive the morbid products of the worms or that other unknown morbid material which gave rise to her fever.

The nausea which she so frequently suffered from even when not taking salol, may have depended to a considerable extent on the presence of the worms.

The asthmatic attacks I considered reflex in origin; they certainly disappeared with the diminution in the numbers of worms in her intestine.

The insomnia, debility, inability to lie but in one position, anorexia, irritability of temper, and depression of spirits were secondary to the weakened condition of her body, and therefore only secondarily due to the Trichocephali.

VII. The inadequacy of the treatment hitherto adopted.

An interesting observation by Eberth, in an exhaustive article in *Zeitschrift für Wissenschaftliche Zoologie*, on the anatomy and physiology of what he calls "the most frequent Entozoon in the human body," the *Trichocephalus dispar*, may throw some light on the great powers of resistance of this worm to ordinary modes of treatment. He states that water only changes or affects the skin of the Trichocephalus if it be kept in it for several weeks. Now, if such be the case with a dead worm macerating in water and decaying from within, it is reasonable to expect that the living skin will present even greater resistance to external influences.

Cobbold states that "when treating patients for tape-worm I have repeatedly expelled the whip-worm." He does not, however, state the means he adopted, nor does he mention any case in which he treated a patient for Trichocephaliasis alone.

Heller (to whom we are indebted for what I consider the best article on this subject) speaks with extreme caution on treatment as having any successful result. He states that he has "often observed in patients under treatment for tape-worm, that numbers of Ascarides were expelled along with the segments of

the tape-worm; less frequently I have observed the expulsion of round-worms; but never up to the present time, Trichocephali; this last is obviously due to the greater power of resistance possessed by the latter."

Heller further remarks: "The object to be accomplished by the treatment is, of course, the removal of the worm from the cæcum. Up to the present time we have, however, no remedy that will do this with any degree of certainty. Bremser once saw one of these worms expelled, along with round-worms and thread-worms, from a girl of sixteen years of age, who was under treatment for tape-worms. It is, however, probable that the worm was only carried away mechanically by the action of the purgative. If, in making a microscopical examination of the fæces, the quantity of eggs found is so great as to make it likely that a very large number of worms are present, we ought to try the effect of the Hegar-Simon's method of washing out the intestine, combined with the use of anthelmintics." He further states that santonine, when brought into contact with living Trichocephali, does not seem to have any effect upon them.

No further information as to treatment can be gleaned from writers, except the remarkable case which I have given in full detail as published in the *Lancet*, 9th August 1862, and it is so entirely opposed to all I have learned by reading and observation, and it is so completely ignored by Heller, that I am not disposed to consider it as a case of Trichocephaliasis, more particularly as my patient was treated with calomel for some time without effect on the worms.

In an American System of Medicine the bold statement is made: "The usual remedies addressed to the seat-worm and round-worm will most probably be equally applicable to the long thread-worm." They may be equally applicable — they are certainly not found to be equally efficacious.

The Adequacy of the Treatment by Thymol.

In the treatment of my case no good result followed the prolonged use of any of the many drugs used in expelling the worms, checking the diarrhœa, or controlling the temperature. An exception to a certain extent might be made in the case of salol, which seemed to diminish the fever without interfering with the worms, and probably acted by disinfecting the intestine; but the salol had to be diminished and finally discontinued owing to the persistent nausea, to its passing through the intestine unaltered, and to the urine assuming too pronouncedly the tint given by hydrochinon. Irrigation of the bowel had been carried out very thoroughly—first (by the direction of a French physician), with infusion of chamomile containing some biborate of soda in solution; second (by my direction), with a solution of tannic acid; and, lastly, with salol suspended in water. These were without beneficial effect. Then, as previously stated, irrigation with thymol was resorted to, and as soon as the patient was able to tolerate it sufficiently long, worms began to come away, not in the thymol solution, but in the subsequent stools. When she was able to admit two litres of fluid of the same strength, not only was there an increased number of worms passed but marked diminution of fever, until it disappeared and remained absent for ten days previous to the patient going to Cannes.

The Beta naphthol may have aided in the general result, but it was only taken irregularly, and was not in use at the time the greatest improvement took place.

I was led to adopt thymol from what I remembered of a statement made during the epidemic of cholera in Hamburg four years ago. I regret my inability to refer to the specific article in which it occurred, but the statement was made that thymol was the most effective of all the substances used in arresting the growth of the comma bacillus of cholera in cultivations of that

bacillus. In the *British Medical Journal* of 23rd January 1897—that is, seven weeks after the thymol treatment had been adopted in my case—there appeared a most interesting paper by Mr Otho Galgey, M.R.C.P.L., "On the Prevalence of Ankylostomiasis in St Lucia, and its Treatment." After giving the numbers of patients admitted to hospital for the anæmia and debility which occur in this disease, he recapitulates the various drugs that have been used, some with slight beneficial effect in mild cases, but nothing at all to rely upon. Now this disease resembles Trichocephaliasis in this respect that it is due to an intestinal parasite, and that the diagnosis in either case is made by finding the ova in the fæces. What was of peculiar interest to me was that Mr Galgey, having established his diagnosis, and having learned that thymol was considered a specific for the cause of the diseased condition, proceeded to administer thymol by the mouth to his patients in doses of twenty grains, the second dose being given two hours after the first. He gives details of twenty-three cases, in all of which the administration of thymol was followed by extrusion of Ankylostoma, sometimes few, sometimes many, but in each case followed by greatly improved health. These cases occurred among coolies, both adults and children, and the writer states that the habit of eating earth (*pica geophagia*) is common among this class of people, and so also is Ankylostomiasis. Leuckart remarks in connection with this: "In the same way we may explain the very abundant occurrence of parasites which Vix has lately shown to be attendant on those mental diseases which are characterised by voracity. The dirt-eating, which Vix would regard as a consequence of the helminthiasis, seems more probably the cause of it."

At Dinan, where my patient resided for nearly a year before coming to Scotland last year, and where she largely indulged in her geophagia, I am informed that it is a travesty on words to speak of sanitary arrangements, as these are non-existent or

most primitive. I am promised some of the earth, and intend to search for the ova of the Trichocephalus.

Towards the end of February 1897, in the *Medical Annual* for this year, there appeared (page 113) an article on the same subject by David Hardie, M.B., Brisbane. His conclusions as to treatment are much the same as those of Mr Galgey. Under the old method the patients sometimes left the hospital improved in general health, "but ova were still present largely in the stools; and, when sent home from the hospital, the patients almost invariably returned sooner or later in as anæmic a condition as before." A year ago it was decided by Dr Turner to give thymol in the large doses recommended by Sonsino, and this was followed by such marked success, "that this treatment may be looked on as specific for the disease." When this treatment described (page 114) is thoroughly carried out, it seems possible to get rid of the ova entirely.

In the case of the Ankylostomum the parasite is high in the intestinal tract, hence the treatment by the mouth is necessary; on the other hand, in the case of the Trichocephalus, the parasite is in the large intestine, and can most readily and directly be reached by lavage by gravitation carefully carried out; and not only is the worm readily got at, but this without the necessity of giving a somewhat nauseous drug by the mouth, and possibly, as in such a case as mine, deranging the stomach, and almost certainly disgusting the patient.

I directed the patient to call on Dr M'Dougall at Cannes. I wrote to him asking him to make an examination of the fæces, and if the ova were at all numerous, or the worms being found, to administer some thymol in cachets if the state of the patient warranted it. For it must be remembered that, although greatly diminished in numbers, ova could still be found, and worms were quite easily got after irrigation with the thymol solution, so that the treatment must be continued, and even more emphatically (seeing that the patient is so much abler

and more willing to submit to it), till all ova and worms have disappeared.

What I respectfully submit has been achieved by the treatment adopted is,—

1. That the Trichocephali have been rendered inoperative for evil, that they are being steadily weeded out—even if they have not all been got rid of, yet the process is still going on, and must end in their extirpation.

2. That the patient, who was in a condition of extreme emaciation and weakness, who suffered much distress from the fever, diarrhœa, and nausea, who was only able to lie in one position on a water-bed, and for whom the prognosis early in December was very grave, has been restored to health, and enabled to resume the duties of an active life.

APPENDIX.

LIST OF PREPARATIONS

ILLUSTRATING THE DIFFERENT POINTS IN CONNECTION WITH TRICHOCEPHALUS DISPAR.

1. Alvine evacuation passed in December. Rich in ova of *Trichocephalus dispar.*
2. Alvine evacuation passed on 18th February.
3. Two slides from No. 1, showing the ova among the fæcal matter.
4. Two drawings of the ova—one high-power, one low-power.
5. Microphotograph of an ovum.
6. Two sections in the long axis of the female worm, showing the ova in position and at different stages of development.
7. Four microphotographs of No. 6.
8. Two stained preparations of male worm.
9. Two stained preparations of female worm.
10. Female worm in spirit.
11. Male worm in spirit.
12. Temperature chart, showing as far as could be done the pyrexia of the intermittent fever.

NOTE.—I have not attempted to give any account of the anatomy of the Trichocephalus, further than what is necessary from a clinical point of view. My preparations are therefore limited to the illustration of its fecundity as shown by the numbers of ova, the general appearance presented by the worm itself, and the characteristic appearance of the ova.

The following Table of Statistics, founded on post-mortems made by Professor Zenker, in Erlangen and Dresden, is taken from K. Müller's *Dissertat. inaugur.*, Erlangen, 1874 :—

I. ERLANGEN. 1862-1872.

	Number of Post-mortems.	Cases of Ascaris.	Oxyuris.	Trichocephalus.
Men - - -	845	93 = 11 per cent.	113 = 13·4 per cent.	107 = 12·7 per cent.
Women - - -	513	81 = 15·7 „	57 = 11·1 „	69 = 13·5 „
Children (under 15 years) - -	397	53 = 13·3 „	43 = 10·8 „	19 = 4·8 „
Total,	1755	227 = 12·9 „	213 = 12·13 „	195 = 11·11 „

In this table the results of 138 post-mortems made on patients at the Insane Asylum, which gave much higher percentages, are not included. In every one of these cases one or more varieties of worms were found ; in 135 cases round-worms were found in the following combinations :—

1. *Ascaris lumbricoides :* alone - - - - - - -		14
With Oxyuris - - - - - - -		6
„ Trichocephalus - - - - - -		8
„ Oxyuris and Trichocephalus - - - -		11
		39
2. *Oxyuris vermicularis :* alone - - - - - - -		35
With Trichocephalus - - - - - -		26
	Total,	61

3. *Trichocephalus dispar :* alone, 35.
Ascaris 39, Oxyuris 52, Trichocephalus 80.

II. DRESDEN. 1852-1862.

	No. of Post-mortems	Ascaris.	Oxyuris.	Trichocephalus.
Men - - -	1164	95 = 8·1 per cent.	24 = 2·1 per cent.	35 = 3 per cent.
Women - - -	739	70 = 9·5 „	19 = 2·5 „	11 = 1·5 „
Children - -	36	15 = 41·6 „	0 = 0 „	4 = 1·1 „
Total,	1939	180 = 9·1 „	43 = 2·1 „	50 = 2·5 „

Since I have entered upon my appointment at Kiel, 782 post-mortems have been made at the Pathological Institute. As a general rule attention was paid to the absence or presence of worms, and when they were found it was noted down. The following statistical survey, though founded on a comparatively small number of cases, is of importance on account of the present great dearth of reliable material.

Number of post-mortems from 1st October 1872 to 30th September 1875 - -		782
Untrustworthy - - 52 }		
Under six months old 119 } - - - - - - - - -		171
Leaving for our purpose - - - - - - - - -		611
Of these 266 were men	and 126 or 47·3 were infested with parasites.	
„ 194 „ women	96 or 49·4	
„ 151 „ children under 15	69 or 45·7	
Total, 611	291 = 47·6 per cent.	

1. *Ascaris lumbricoides:* alone		32
Was found with Oxyuris		16
„ Trichocephalus		26
„ Oxyuris and Trichocephalus		34
	Total,	108
2. *Oxyuris vermic.:* alone		57
With Ascaris		16
„ Trichocephalus		35
„ Ascaris and Trichocephalus		34
	Total,	142
3. *Trichocephalus dispar:* alone		90
With Ascaris		26
„ Oxyuris		35
„ Ascaris and Oxyuris		34
	Total,	185

Thus, in the 611 post-mortems:

Ascaris lumb.	was found in	17·7 per cent.
Oxyuris vermic.	„	23·2 „
Trichocephalus dispar	„	30·6 „
Round-worms	„	47·6 „

Age of the youngest individual, with—Ascaris, 2 years; Oxyuris, 5 weeks; Trichocephalus, 11 months. The age of the eldest with—Ascaris, 78 years; Oxyuris, 82 years; Trichocephalus, 89 years.

Printed at THE DARIEN PRESS, *Edinburgh.*